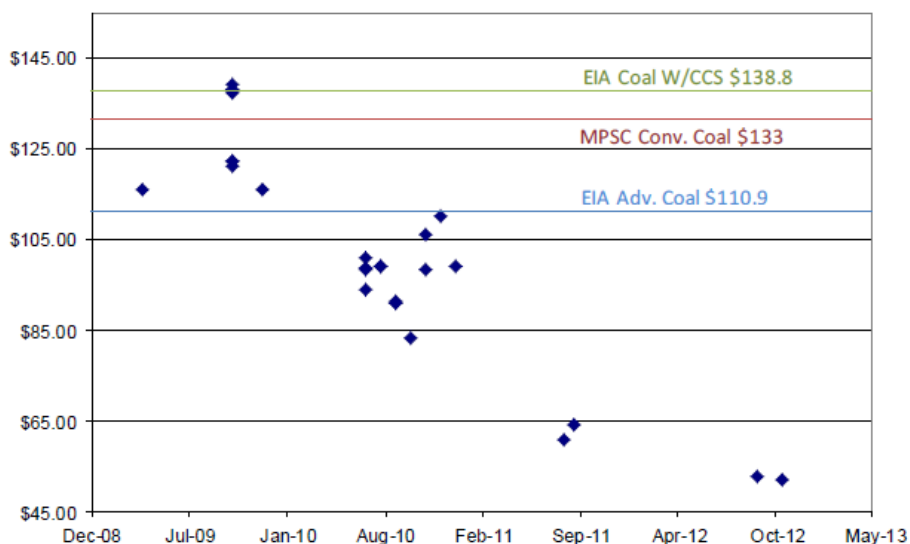


Renewable Energy Question #3: How do Michigan's costs for RE compare to the cost of existing generation and to the cost of new non-renewable generation today?

Perhaps the best source of data on the recent costs of generating electricity from renewable energy in Michigan comes from the Michigan Public Service Commission's (MPSC) February 2013 renewable energy standard compliance report. The figure below from that report shows that the cost of renewable energy (primarily wind) contracts approved by the MPSC have declined significantly over time, and most of the contracts are well below the cost of building and operating a new coal plant. These contracts are dominated by wind power, which represents 94 percent of the total new renewable energy capacity approved by the MPSC through 2012. In fact, the most recent wind contracts approved by the MPSC (in the \$52/MWh range) are below EIA's estimated levelized cost of \$65.6/MWh for building and operating a new advanced natural gas combined cycle plant.

**Figure 10: Levelized Cost of MPSC Approved Contracts Over Time
Compared to the Cost of New Coal Fired Facilities**



According to the MPSC report, the weighted average cost of all the renewable energy contracts is \$82.45/MWh. The weighted average contract prices for different renewable energy technologies are shown the table below. With the exception of two small anaerobic digesters and one small landfill gas project, all of the other contracts are lower than MPSC's estimated cost of \$133/MWh for a new conventional coal plant, which includes a price on CO₂. And most of the contracts are cheaper than EIA's estimated cost of \$111/MWh for a new advanced coal plant, which includes a modest CO₂ price of approximately \$15/ton. [Note that EIA's most recent estimate of the levelized cost of a new advanced coal plant with an in-service date of 2018 has increased to \$123/MWh.]

Table 2: Weighted Average Levelized Renewable Energy Contract Prices

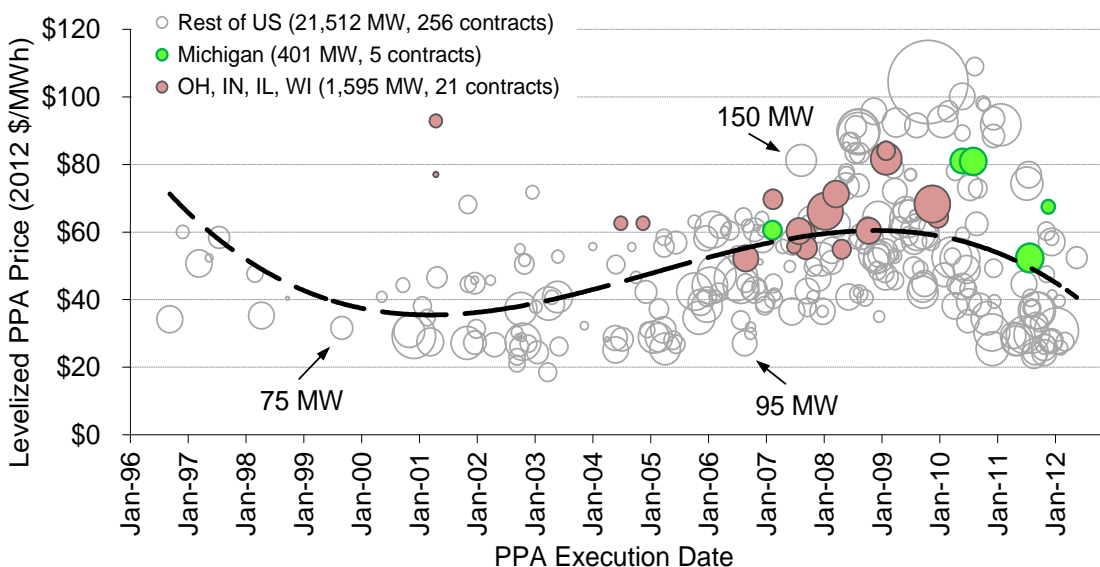
Consumers Energy					
Technology	Wind	Digester	Biomass	Landfill	Hydro
Weighted Average	\$101.83	\$137.02	NA	\$105.81	\$121.31
Detroit Edison					
Technology	Wind	Digester	Biomass	Landfill	Hydro
Weighted Average	\$70.08	NA	\$98.94	\$98.97	NA
Combined Weighted Average	\$80.32	\$137.02	\$98.94	\$103.84	\$121.31

We also agree with this statement from the MPSC report that these declining cost trends for renewable energy are likely to continue:

Based on contract pricing trends and the January 2013 announcement that federal legislation extended the eligibility of the Production Tax Credit for projects that begin construction by December 31, 2013, Commission Staff anticipates that the cost of renewable energy will continue to decline, while the benefits from energy optimization savings and emission reductions from offset generation will continue to increase. The extended tax credit will undoubtedly provide further opportunity for Michigan ratepayers to continue benefiting from reduced renewable energy costs.

The downward trend in the cost of wind projects is evident in Figure 1 below based on data from Lawrence Berkeley National Laboratory (LBNL) for a large sample of wind projects installed in the U.S. between 1996 and 2012. The figure shows that the weighted average power purchase agreement (PPA) prices for wind projects (the black dashed line) have fallen from about \$60/MWh to \$40/MWh, or one-third, over the past three years. This is due primarily to reductions in capital costs and improvements in capacity factors resulting from technological improvements and taller towers. The figure also shows that the costs of several wind projects installed in Michigan (green circles) and surrounding states (pink circles) are roughly within the same range (~\$50-80/MWh), and are generally at or above the national weighted average cost from the sample. This reflects the fact that the wind resource in these states is not as strong as other parts of the country, particularly the plains states, but are similar to projects installed on the east and west coasts.

Figure 1. Levelized Prices for Wind Power Purchase Agreements (PPAs) Installed in the U.S. Between 1996 and 2012.



Source: Personal communication with Mark Bolinger, Lawrence Berkeley National Laboratory, April 2013.

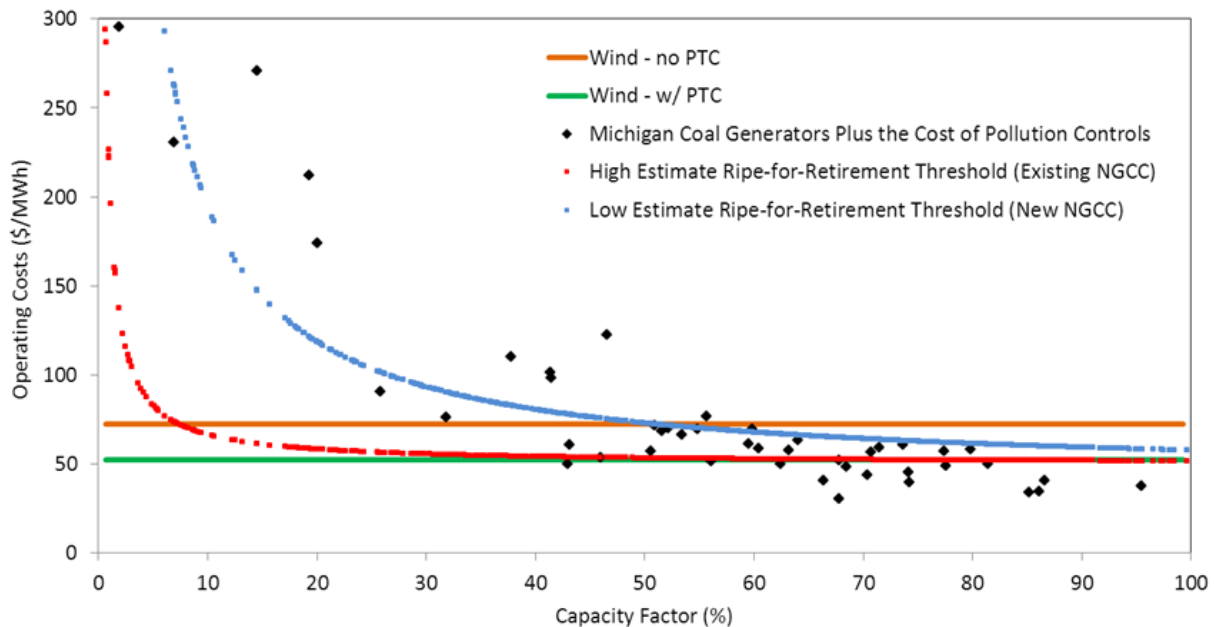
A November 2012 study by the Union of Concerned Scientists (UCS), *Ripe for Retirement*, also found that it would be more expensive to retrofit many existing coal plants in Michigan with modern pollution control equipment than retiring and replacing them with new wind projects, new and existing natural gas power plants, and energy efficiency. The study ranked Michigan fifth in the country in terms of total capacity (3,684 MW) that was more expensive to retrofit with pollution controls than purchasing electricity from these cleaner alternatives. Michigan also ranked first for having the greatest number of coal generators on the list, with 39 units. Most of these generators are small, averaging 94 MW, and old, averaging 52 years in age.

When UCS completed this analysis, only two coal generators representing 112 MW of capacity (at the Presque Isle plant) had been announced for retirement. Over the past five months, an additional seven coal generators representing 437 MW of capacity at three plants (Harbor Beach, J.R. Whiting, James De Young) have been announced for retirement in 2015 and 2016. Six out of seven of these generators were on the list of economically vulnerable generators, which provides some important validation for the credibility of the analysis.

Figure 2 and Table 1 below show the coal generators and coal capacity in Michigan that was identified as economically vulnerable in the analysis under different scenarios. These results were adjusted from the original report to reflect the recently announced retirements. Figure 2 shows that with the costs of new pollution controls included, the operating costs of 33 coal generators (black diamonds) representing 3,140 MW of capacity are more expensive than an average existing NGCC plant (red dotted line), while 11 generators representing 694 MW of capacity are more expensive than a new NGCC plant (blue dotted line). It also shows that 36 coal generators totaling 4,088 MW of capacity are more expensive to retrofit with pollution controls than retiring and replacing the plants with new wind projects (including the PTC—green line) that have similar costs of recently developed wind projects in Michigan. A

significant amount of additional existing coal capacity is economically vulnerable in Michigan with a modest cost of \$15/ton for CO₂ and low natural gas prices.

Figure 2. Operating Costs of Ripe for Retirement Coal Generators vs. Existing and New Natural Gas Plants and Wind Power Facilities



Source: Cleetus et al 2012.

Table 1. Coal Generators and Capacity Deemed Ripe for Retirement in Michigan under Alternative Scenarios.

Ripe for Retirement Scenario	Number of Generators	Capacity (MW)
Announced Retirements	9	549
Existing coal without new pollution controls (PC) vs. existing Natural Gas Combined Cycle (NGCC)	6	182
Existing coal with new PC vs. new NGCC	11	694
Existing coal with new PC vs. existing NGCC	33	3,140
Existing coal with new PC vs. wind with PTC	36	4,088
Existing coal with new PC vs. existing NGCC – both with \$15/ton CO ₂ Price	42	6,128
Existing coal with new PC vs. existing NGCC with 25% lower natural gas prices (\$3.66/MMBtu)	45	8,685
Total existing coal fleet in MI included in analysis	59	12,431

Source: Cleetus et al 2012.

References:

- 1) Michigan Public Service Commission. 2013. *Report on the Implementation of the P.A. 295 Renewable Energy Standard and the Cost-Effectiveness of the Energy Standards*. Online at http://www.michigan.gov/documents/mpsc/implementation_of_PA295_renewable_energy_411615_7.pdf.
- 2) Energy Information Administration (EIA). 2013. Levelized Cost of New Generation Resources in the Annual Energy Outlook 2013. Online at: http://www.eia.gov/forecasts/aeo/er/electricity_generation.cfm
- 3) Cleetus, R., S. Clemmer, E. Davis, J. Deyette, J. Downing, and S. Frenkel. 2012. Ripe for Retirement: The Case for Closing America's Costliest Coal Plants. Union of Concerned Scientists: Cambridge, MA. Online at: http://www.ucsusa.org/assets/documents/clean_energy/Ripe-for-Retirement-Full-Report.pdf